p. 38), which he regards as intermediate between Reptilia and Mammalia. He says:—"The order Theromorpha approximates to the Mammalia more closely than any other division of Reptilia. This approximation is seen in the scapular arch and humerus, which nearly resemble those of the Monotremata, especially Echidna; and in the pelvic arch, which Owen has shown in the sub-order Anomodontia to resemble that of the mammals, and, as I have shown, especially that of Echidna. The tarsus is also more mammalian than in any other division of reptiles. In the genus Dimetrodon the coracoid is smaller than the epicoracoid, as in Monotremes. The pubis has the foramen for the internal femoral artery." Cope also appears to have found in the Theromorpha a spur attached to the hind foot, just as in the males of Monotremata.

In the skeletons of the latter, on the other hand, we find several prominent features in which, whilst they differ from the typical mammalian forms, they approximate more or less closely to the reptiles, whilst finally Mr. Caldwell's discovery with regard to the nature of the ovum has shown that Mammalia and Sauropsida are closely allied to each other—more intimately than has generally been allowed by naturalists.

In Monotremes we find, as it were, intermediate animals possessing the attributes of two classes: whilst on the one hand they have developed mammary glands, the distinctive feature of the higher group, on the other they lack that structure whereby the typical mammalian embryo receives nourishment before birth; and in correlation with this we find them agreeing with the lower class in the possession of a yelk-sac, whilst the contained food-yelk causes the ovum to assume the meroblastic type.

We may thus trace the line of descent through the Sauropsida directly to the Monotremes (doubtless through forms now extinct, as the Theromorpha of Cope); from these to Marsupials, which are indeed viviparous, but whose ova still possess a large yelk-sac, and whose embryos, as Mr. Caldwell (*Q.J.M.S.* October 1884) has just shown, enter into no close vascular connection with the maternal tissues; and from these to the higher mammals, whose much specialised structures for fœtal development differ now so widely from those of the lower vertebrates.

W. BALDWIN SPENCER

NOTES

LAST Thursday (December 4) the Chemical and Physical Society of University College, London, gave a scientific *soirée* in connection with the University College Society. Prof. T. G. Bonney delivered the annual address, and took as his subject "Serpentine Rock and its Origin." The lecture was illustrated by Wright and Newton's new oxy-hydrogen microscope. During the evening demonstrations were given on "Radiant Matter" by Mr. Rose Innes, "Absorption Spectra" by Mr. Schunck, and "Ozone" by Mr. E. E. Craves, in various parts of the building. In the library were exhibited by several gentlemen and manufacturers new scientific apparatus and chemical compounds. The physical and chemical laboratories were thrown open to visitors, and in them were shown new forms of apparatus for research. The meeting was numerously attended, and the committee are to be congratulated on the success of the evening.

THE ordinary general meeting of the members of the Parkes Museum was held on Thursday, December 4, Capt. Douglas Galton, C.B., F.R.S., in the chair. The meeting was held to consider the report of the Council for the tenth year and to elect officers. The report set forth the work done in connection with the Museum during the past year, which had included lectures by the Council of the Sanitary Assurance Association in addition to those arranged by the Council of the Museum. The accounts showed that there was urgent need for increased subscriptions if the Museum was to be continued, for the small invested capital had had to be made use of this year to meet the current expenses. The report was adopted on the motion of the Chairman, seconded by Mr. Rogers Field. Mr. Mark H. Judge, then proposed "That the report be printed for circulation, with a detailed statement of the financial position of the Museum, and that a special meeting of the members be convened within two months to consider the same." This was seconded by Mr. E. C. Robins, and carried unanimously. Sir R. Lloyd Lindsay, Prof. J. Marshall, F.R.S., and Mr. Alfred Waterhouse, A.R.A., were elected Vice-Presidents. Six new Members of Council were elected, and the meeting closed with a vote of thanks to the Chairman, proposed by Dr. J. C. Steele of Guy's Hospital.

WE have before us a most satisfactory report of the Manchester Public Free Libraries for 1883–84, showing increase everywhere. More than one and a quarter million of issues have been made to two and a half million of visitors to the libraries. Of these the boys have been provided with additional reading-rooms to themselves, which are reported as crowded every evening; the increased Sunday issues of books also are noted as being specially made to boys, and it cannot be doubted that a taste for reading thus early implanted will save them from half the temptations to which idle youth is subjected. While nearly 10,000 new books have been purchased, more than 10,000 have been started in new harness for fresh toil by the bookbinder; and few items can speak better of "something accomplished, something done," than 3325 volumes withdrawn from circulation, simply worn out. At one branch a new catalogue published, at another one preparing, and at a third two supplementary lists issued, keep the value and the availability of the books at the highest point.

AT the meeting of the Geologists' Association last Friday, Mr. R. Meldola gave a preliminary account of his investigation of the East Anglian earthquake of April 22, 1884, with special reference to the geology of the question. The extreme limits of the recorded disturbance were Brigg in Lincolnshire, Altrincham in Cheshire, Worcester, Bristol, Street (Somersetshire), Boulogne, and Ostend, giving in round numbers an area of 50,000 square miles. The focus of the disturbance appears to have been beneath the earth near the villages of Abberton and Peldon, between Colchester and Mersea Island, and there seems to have been total reflection of the shock at Wivenhoe on the River Colne, the tract of country to the north-east of this village, where great damage was sustained, being in "seismic shadow." The area of structural damage comprised about fifty or sixty square miles, the main axis being along a line five miles in length and extending in a S.W.–N.E. direction from Peldon to Wivenhoe. The evidence showing the propagation of the shock along the older rocks had been carefully considered, and the conclusion had been arrived at that such a spreading of the shock towards the west, north-west, south-west, and south-east had actually taken place, an additional argument in favour of the extension of the Palæozoic rocks beneath the south-east of England, as first suggested by the late Godwin-Austen in 1855, being thus furnished. It was pointed out that this extension of the disturbance along the older rocks was of a purely dynamical character, depending simply upon the superior elasticity of these formations. One phase of earthquake movement which the present disturbance appears to have revealed with special distinctness was the tendency of the shock to make itself felt along free margins such as coast-lines, river-valleys, lines of outcrop, &c. The general conclusion respecting the distribution of earthquakes in this country which the present investigation

had led to was that earthquakes having their focus in the east of England would be likely to extend much further west than those originating in the west would extend eastwards, this depending upon the geological structure of the country and being supported by the records of previous British earthquakes, of which a complete catalogue was in course of preparation. Mr. Meldola stated that the complete report, which was very voluminous, was nearly ready for publication.

WITH reference to the palæontological discovery of a fossil scorpion in the Upper Silurian formation of Gothland, recently made by Prof. G. Lindström of the Academy of Sciences, Stockholm, which has attracted considerable attention on the Continent, we have received the following communication from this *savant*:—"The discovery was made in the latest Upper Silurian layer. Only the thin chitinous coat has been preserved, all the soft membranes having decayed, and the body is compressed, owing to the pressure of the superincumbent layers. Like the scorpions existing at the present time, its body consists of the cephalothorax, seven abdominal membranes, and seven segments in the tail, of which the seventh is distinctly shaped into a poisonous sting. Both the great claws (*palpi*) still remain; the number of legs was eight, those of the left side being in perfect condition. They differ entirely from all known scorpions, fossil or living, by the joints being thick and heavy and the leg ending in a point instead of claws. There is a marked respiratory cavity (*stigma*) on the right side, from which I draw the conclusion that it was not only an air-breathing animal but an animal living on *terra firma*. Its whole construction points to this. It is the oldest known land-animal, the limits of our knowledge as to its existence during past ages having been extended from the Middle Devonian strata of Canada, where remains of Neuroptera have previously been found, to the uppermost strata of the Upper Silurian formations."

THE Mersey Tunnel is now completely arched in under the river with the exception of the inverts. It is interesting to geologists to know that, about three hundred yards from the Liverpool side, the upper part of the tunnel intersected the pre-Glacial bed of the river for a distance of about one hundred yards. This "gully" in the rock was filled with hard Boulder-Clay, with erratic boulders resting upon the hard denuded surface of the Triassic sandstone. As showing the importance of a knowledge of geology in engineering works, this pre-Glacial gully was, in opposition to the prevailing opinion, foreseen and predicted as one of the difficulties that would have to be encountered in the tunnel-works in a paper by Mr. Mellard Reade, entitled "The Buried Valley of the Mersey," published in the *Proceedings* of the Liverpool Geological Society in 1872. It is very satisfactory to know that this difficulty is now surmounted, and the stability of this important and interesting work placed beyond a doubt.

AS we anticipated some weeks ago, M. Joseph Bertrand has been elected a Member of the Académie Française almost without opposition, having obtained twenty-five votes out of a total of twenty-six, the single dissentient voice having been given in favour of a poet who could hardly be termed a candidate. M. Bertrand's formal reception into the Academy will take place in the course of a few months, and M. Pasteur is to reply to the speech he will deliver on the occasion.

M. JANSSEN is at present engaged in drawing up for the Academy of Sciences a full report of his mission to the Prime Meridian Congress at Washington. He is also to deliver a lecture on the subject before the Geographical Society of Paris. The learned astronomer still adheres to his scheme of a neutral meridian.

MANY of our readers are aware that when Mr. Thiselton Dyer, more than ten years ago, introduced at South Kensington a system of instruction in botany based on the same principle as the instruction in animal morphology already introduced by Prof. Huxley, he intended to put together the results of his experience in the form of a hand-book for the use of other teachers. Pressure of other work prevented his carrying out his intention, but Mr. F. O. Bower, now Lecturer in Botany in the Normal School of Science, took the task in hand in conjunction with Dr. Sydney Vines, and we are glad to be able to announce that Messrs. Macmillan and Co. will publish a first instalment of the work immediately. When complete, according to the original scheme, the work is intended to contain a general introduction by Mr. Dyer, introductory chapters on methods and on the morphology of the cell by Dr. Vines, and then the description of a series of types representing the various groups of the vegetable kingdom. In each case a short general description will precede the directions for investigating the type in the laboratory. The instalment now promised will contain an explanatory preface by Mr. Dyer, the two introductory chapters by Dr. Vines, and the directions for laboratory work on vascular plants, as represented chiefly by the following types:—*Helianthus annuus*, *Ulmus campestris*, *Zea Mais*, *Pinus sylvestris*, *Selaginella Markensii*, *Lycopodium claratum*, *Aspidium Filix-mas*, and *Equisetum arvense*. It is hoped to publish the laboratory directions for the remaining types, and the short prefaces to each type, before very long. For the laboratory directions Mr. Bower is mainly responsible; the descriptive prefaces will be contributed by Mr. Dyer; but the whole work will have undergone the minute supervision of all the three authors concerned, and represent their united experience.

MESSRS. MACMILLAN AND CO. promise immediately an abridged edition, for popular use, of the "Life of Prof. J. Clerk Maxwell."

THE following are the lecture arrangements at the Royal Institution before Easter 1885:—Six lectures (adapted to a juvenile auditory) by Prof. Tyndall, on the Sources of Electricity, on December 27 and 30, 1884, January 1, 3, 6, and 8, 1885; five lectures by Prof. H. N. Moseley, on Colonial Animals, their Structure and Life-Histories, on Tuesdays, January 13 to February 10; four lectures by Dr. Arthur Gamgee, on Digestion, on Tuesdays, March 3 to 24; eleven lectures by Prof. Dewar, on the New Chemistry, on Thursdays, January 15 to March 26; three lectures by Dr. Waldstein, on Greek Sculpture from Pheidias to the Roman era, on Saturdays, January 17 to 31; three lectures by Mr. G. Johnstone Stoney, on the Scale on which Nature works, and the Character of some of her Operations, on Saturdays, February 7 to 21; and five lectures by Mr. Carl Armbruster, on the Life, Theory, and Works of Richard Wagner (with illustrations, vocal and instrumental), on Saturdays, February 28 to March 28. The Friday evening meetings will begin on January 16, when Prof. Tyndall will give a discourse on Living Contagia.

THE archæologist M. Saillard, well known through his indefatigable efforts for the preservation of dolmens, has discovered the workshop of a prehistoric armourer or smith on a steep rock by the sea on the south-west side of the peninsula of Quibéron (Brittany). It dates from the Stone Age. Polished lances, arrow-heads, axes, and other objects are represented in great numbers and in every stage of manufacture, so that the discovery is most interesting, inasmuch as the objects illustrate the workman's method and process. Amongst the objects is also a meteoric stone worked into an implement. The skeleton of the workman was also found, the skull being very well preserved.

DR. AUGUSTUS VOELCKER, F.R.S., died on Friday last, the 5th inst., at his residence, 39, Argyll Road, Kensington, in his sixty-second year. He was born at Frankfort-on-the-Maine,

received his chief education at the University of Göttingen, and in early life came to England. After that time he successively held the post of assistant to the late Prof. Johnston at Edinburgh, Professor of Chemistry in the Royal Agricultural College at Cirencester, and Professor of Chemistry to the Royal Agricultural Society of England, and was well known as the author of several works in theoretical and agricultural chemistry, such as the "Chemistry of Food" and the "Chemistry of Manure."

THE *Journal of Botany* for December contains a memoir of the late George Bentham, accompanied by an excellent photograph.

WE have received the prospectus of the Royal Agricultural College, Cirencester, issued during the past month. The course of instruction provided in technical and scientific subjects appears to be ample for the requirements of the agricultural students. We are glad to notice that external examiners are appointed for the final examination of students for the diploma, and also that a Board of Studies, in which are several professors otherwise unconnected with the College, exists. The number of students is steadily increasing, and among them are several Indian scholars sent by the Governments of Bengal and the North-West Provinces. The Governments of the Indian Presidencies also encourage some of their civil servants to pass through the College course when on leave of absence in this country.

ON the subject of agricultural education, a correspondent writes to the *Times* that a number of meetings have recently been held in Oxfordshire and Buckinghamshire with a view to the establishment of night classes during the winter for teaching the scientific principles of agriculture. There is, he says, a growing opinion among the more educated young men that agriculture requires something besides Commissions and inquiries and fair trade. It has been estimated that the annual waste from careless and unskilful methods of managing manure amounts to nearly five millions sterling. Add to this the want of knowledge in the purchase of artificial manures and their application, the waste of feeding-stuffs, the odd pieces and corners of fields that might grow other things beside rank weeds and couch-grass, and the waste of time in going to markets, auctions, and fairs. No reduction of rent or local taxation, or increased price of wheat, will, says this correspondent, do anything for men who make no effort to improve their industry by increased scientific knowledge. The natural history of the wire-worm, the leather-jacket, the dissolving of bones, the building up of plants, the judicious mixing of food, and many other things which farmers would be the better for knowing can never be acquired by what is called practical farming, and accordingly these classes are commended to the consideration of all who take an interest in the welfare and education of young men in rural districts.

THE additions to the Zoological Society's Gardens during the past week include a Yellow Baboon (*Cynocephalus babouin* ♂), a Chacma Baboon (*Cynocephalus porcarius* ♀) from the East Coast of Africa, presented by Capt. Edward Jones, R.N.R.; a Macaque Monkey (*Macacus cynomolgus* ♂) from India, presented by Mr. Geo. Airey; a Bittern (*Botaurus stellaris*), British, presented by Mr. Robert Page; a —— Otter (*Lutra* ——) from South America, a Cat Fish (*Amiurus catus*) from North America, deposited; two Rock Pipits (*Anthus obscurus*), British), a Passerine Owl (*Glaucidium passerinum*), a Crested Titmouse (*Parus cristatus*) from Siberia, purchased.

OUR ASTRONOMICAL COLUMN

WOLF'S COMET.—Herr Lehmann-Filhés of Berlin has made a first approximation to the amount of perturbation experienced by this comet at its near approach to the planet Jupiter in 1875, to which attention was directed in NATURE (vol. xxx. p. 615). He adopts the orbit determined by Prof. Krueger upon observations extending over an interval of forty-eight days, and applies the formulæ of the "Mécanique Céleste" (liv. ix. chap. ii.), which were first employed by Burckhardt in the case of the celebrated Lexell comet of 1770. The following are the elements deduced for perihelion passage in 1868, or the elements defining the orbit of the comet previous to its close approach to Jupiter; we annex Prof. Krueger's orbit for the present appearance for comparison :—

	Lehmann-Filhés, 1868	Krueger, 1884
Perihelion passage ...	Sept. 24·6 M.T. Berlin	Nov. 17·7922
	° ′ ″	° ′ ″
Perihelion	352 36 48	19 3 17
Ascending node	207 33 50	206 22 17
Inclination	27 36 49	25 15 10
Angle of excentricity ...	16 11 5	34 3 12
Log. semi-axis major ...	0·663970	0·552936
Mean daily motion ...	358″·14	525″·536

The longitudes in both orbits are reckoned from the mean equinox 1884·0.

Prof. Krueger writes modestly as to the degree of accuracy of his elements, which have been adopted by Herr Lehmann-Filhés, nevertheless they were founded upon a fairly-wide interval of observation as noted above. From the nature of the problem, however, the orbit for 1868 must be regarded as roughly indicating the kind of track which the comet was then following. And it is to be remarked that the perihelion distance corresponding to the assigned values of excentricity and semi-axis major is 3·327, which would account for such a comet not having been observed while moving in the orbit of 1868. Thus, as in several previous cases, the comet appears to have been brought within range of visibility from the earth by the powerful attraction of the planet Jupiter.

THE WASHBURN OBSERVATORY, WISCONSIN.—Vol. ii. of *Publications* of this Observatory has been issued. Its main feature consists in a reduction of the star-gauges of Sir William Herschel, published and unpublished, or 683 gauges published and 405 unpublished, Prof. Holden having been indebted for the latter to Lieut.-Col. Herschel, R.E., who forwarded to him a complete copy of a manuscript, by Miss Caroline Herschel, in which they are given, and who was at the further trouble of extracting from the Herschel papers in the library of the Royal Astronomical Society the dates of the various sweeps. Also of 500 counts of stars from the published charts of Prof. C. H. F. Peters, 983 counts from his unpublished charts and those of Watson and Chacornac, and 781 from those of Palisa. Prof. Holden states that he is now discussing these various gauges by a graphical process, and that they promise to lead to very interesting results, especially when they are supplemented by other star-gauges covering the same ground and made by a larger instrument. The volume further contains a list of 111 new double-stars and two new nebulæ, with observations of red or coloured stars between December 1881 and the end of 1883, in continuation of a list given in the first volume.

GEOGRAPHICAL NOTES

REPORTS have been received from M. Alfred Marche, who is travelling through the Philippine Archipelago on a scientific mission for the French Ministry of Public Instruction. During June and July last he explored the archipelago of Calamienes, situated to the south-west of Mindoro and to the north of Paluan (Paragua) Island. This archipelago is composed of three large islands, Busuanga, Calamienes or Culion, and Linacapan, and about thirty smaller ones. M. Marche first visited Culion, the inhabitants of which are Tagbannas, similar to those whom he observed in a previous journey to Paluan. These form the principal as well as the most ancient people of the peninsula, and it is probable that formerly they occupied a much larger area than they do now. A small number of them, more or less Christianised, have submitted and built a village, to which, however, they come as rarely as possible. The others are independent, and are fetish-worshippers. In Culion there is but a single Spaniard, the priest. After Culion, M. Marche visited the island of Busuanga, where there were formerly Chinese colonies engaged in collecting birds' nests, and in trepang and pearl-fishing, both industries which no longer exist. In spite of continual rains the traveller was able to make a large collection of plants and of woods of all kinds. In Busuanga he came